

What is claimed is:

1. A method for specifying measurement start times in a network Measurement Request Frame (300), comprising the steps of:
formatting the Measurement Request Frame (300) to have a Measurement
5 Request Elements field (305) comprising at least one Measurement Request Element (400,440), said at least one Measurement Request Element (400,440) comprising at least one Measurement Request (406,410) for a given type (405) of network measurement
specifying at least one of a first (304), second (408) and third (432) prioritized
10 absolute Start Time, respectively, in a corresponding at least one of the Measurement Request Frame, the Measurement Request Elements (440), and the at least one Measurement Request (406).
2. The method of claim 1 where in said first (304), second (408) and third
15 (432) Start Time field indicate in increasing priority order an applicable absolute Start Time, respectively, at which measurement of the first included Measurement Request Element (305) is to be initiated, the corresponding Measurement Request Element (440) is to be initiated, and the corresponding Measurement Request (432) is to be initiated.
- 20 3. The method of claim 1, further comprising the step of setting said first (304), second (408) and third (432) Start Time field to one of a time synchronization function (TSF) timer (106) value and part of a TSF timer (106) value.
- 25 4. The method of claim 1, further comprising the step of setting at least one of the first (304), second (408), and third (432) Start Time field to zero to indicate that the corresponding measurement is to be initiated after reception of the Measurement Request Frame (300).
- 30 5. The method of claim 1, further comprising the step of setting at least one of the first (304), second (408), and third (432) Start Time field to zero to indicate

that the corresponding measurement is to be initiated after reception of the Measurement Request Frame (300).

6. The method of claim 1, wherein:

5 said formatting step further comprises the step of including in said measurement request frame the following fields -

	Category	Action	Dialog Token	Measurement Frame or first Start Time	Measurement Request Elements
Octets:	1	1	1	8	variable

- 10
 - a Category field (301) set equal to the value indicating a Radio Measurement or Spectrum Management category,
 - an Action field (302) set equal to the value indicating a Measurement Request,
 - a Dialog Token field (303) set equal to a non-zero value chosen by the transmitter of the Measurement Request Frame (300) in order to identify the request/report transaction,
- 15
 - an optional Measurement Frame/first Start Time (304) field set to a TSF timer (106) value, at which the measurement specified by the first of the Measurement Request Elements (305) is to be initiated and if the Measurement Frame/first Start Time (304) is set equal to zero, the measurement specified by the first Measurement Request Element (305) is to
- 20
 - begin after reception of the Measurement Request Frame (303),
 - a Measurement Request Elements field (305) having at least one Measurement Request Element (400,440) comprising the following subfields -

Element ID	Length	Measurement Token	Measurement Mode	Measurement Type	Measurement Element/second Start Time	Measurement Request
1	1	1	1	1	1	variable

Octets:

- an Element ID subfield (401) set equal to a unique identifier,
- a Length subfield (402) is variable and depends on the length of the Measurement Request field (406), and the minimum value of the length field is 3,
- a Measurement Token subfield (403) set to a non-zero number that is unique among the Measurement Request Elements (305) in a particular Measurement Request Frame (300).
- an optional Measurement Mode subfield (404) set to include a Start (407) mode value that specifies the interpretation of the Measurement Frame Start Time (304,408,432) to be applied to the measured element,
- a Measurement Type subfield (405) is set to the type of measurement being requested,
- an optional Measurement Frame/second Start Time field (408) set to a TSF timer (106) value, at which the measurement specified by the first of the Measurement Request Elements (305) is to be initiated and if the Measurement Frame/second Start Time (408) is set equal to zero, the measurement specified by the first Measurement Request Element (305) is to begin after reception of the Measurement Request Frame (300),
- a Measurement Request subfield (406) is set to at least one parameter for accomplishing the type of Measurement Type, comprising the following subfields -

	Channel Number	<u>Measurement Start Time</u>	Measurement Duration
Octets:	1	2	2

- a Channel Number subfield (431) set to the channel number to which the measurement request (406) applies,
- 5 • a Measurement Frame/third Start Time field (432) set to a TSF timer (106) value, at which the measurement specified by the Measurement Request (406) is to be initiated and if the Measurement Frame/third Start Time (432) is set equal to zero, the measurement specified by the Measurement Request (406) is to begin after reception of the Measurement Request Frame (300),
- 10 • a Measurement Duration subfield (433) set to the time over which the measurement is to be done.

7. The method of claim 6, further comprising the step for setting said
 15 Measurement Mode field (404) to a value that specifies how to interpret the applicable one of the first (304), second (408), and third (432) Start Time for starting measurement of the element.

8. The method of claim 7, wherein said step for setting said Measurement
 20 Mode subfield (9404) is the step of setting the Start subfield (407) of the Measurement Mode subfield (404) to an indicator selected from the group consisting of -

The measurement is required to commence at the indicated Start Time,
The measurement is required to commence at some random interval after the indicated Start Time,
The measurement may start at any time,
The measurement is required to start immediately after receiving the request,
The actual measurement start time shall be reported back, and
The actual measurement start time may not be reported back.

9. The method of claim 8, wherein said setting step further comprises the step of using a three bit encoding (407) to represent a selected indicator.

5 10. The method of claim 9, wherein said using step further comprises the step of using the following three bit encoding (407) to represent the selected indicator

x00	The measurement is required to start at the indicated start time,
x01	The measurement is required to commence at some random interval after the indicated start time,
x10	The measurement may start at any time,
x11	The measurement is required to start immediately after receiving the request.
1xx	The actual measurement start time shall be reported back, and
0xx	The actual measurement start time may not be reported back.

10 11. The method of claim 1, further comprising the steps of:
including in the at least one Measurement Request Element (400,440) a Measurement Mode field (404); and

step for setting said Measurement Mode subfield (404) to a value that specifies how to interpret the applicable one of the first, second, and third Start Time for starting measurement of the element.

- 5 12. The method of claim 11, wherein said step for setting said Measurement Mode subfield (404) is the step of setting the Start subfield (407) of the Measurement Mode (404) subfield to an indicator (407) selected from the group consisting of -

The measurement is required to commence at the indicated Start Time,
The measurement is required to commence at some random interval after the indicated Start Time,
The measurement may start at any time,
The measurement is required to start immediately after receiving the request,
The actual measurement start time shall be reported back, and
The actual measurement start time may not be reported back.

- 10 13. The method of claim 12, wherein said setting step further comprises the step of using a three bit encoding (407) to represent a selected indicator.

14. The method of claim 13, wherein said using step further comprises the step of using the following three bit encoding (407) to represent the selected indicator

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x00	The measurement is required to start at the indicated start time,
x01	The measurement is required to commence at some random interval after the indicated start time,
x10	The measurement may start at any time,
x11	The measurement is required to start immediately after receiving the request.
1xx	The actual measurement start time shall be reported back, and
0xx	The actual measurement start time may not be reported back.

15. An apparatus that formats a Measurement Request Frame having an unambiguous measurement Start Time, comprising:

- 5 a measurement acquisition circuit (103) that formats the Measurement Request Frame (300) to have a Measurement Request Elements field (305) that comprises at least one Measurement Request Element (400,440) that comprises at least one Measurement Request (406) for a given type (405) of network measurement;
- a TSF timer (106); and
- 10 a control processor (105), coupled to said measurement acquisition circuit (103) and said TSF timer (106) and configured to set at least one of a first (304), second (408) and third (432) Start Time respectively in the corresponding Measurement Request Frame (300), the Measurement Request Elements (305), and at least one Measurement Request (406), said first (304), second (408) and third (432)
- 15 Start Time set to a value of the TSF timer (106) to indicate in increasing priority order.

16. The apparatus of claim 15, wherein said value of the TSF timer (106) is a part of the value of the TSF timer (106).

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17. An apparatus that specifies flexible measurement start times in a network Measurement Request Frame (300), comprising:

a measurement acquisition circuit (103) that formats the Measurement Request Frame (300) having a Start Time field (304) that specifies the time at which measurement of a first included Measurement Request Element (305) is to be initiated;

5 a timer (106); and

a control processor (105), coupled to said measurement acquisition circuit (103) and said timer (106) and configured to (1) set the Start Time field (304) to a value of the timer (106), and (2) include at least a first Measurement Request Element (400,440) having a Measurement Mode subfield (404); and

10 means for the control processor (105) to set said Measurement Mode subfield (404) to a Start value (4070 that specifies how to interpret the Start Time (304) for starting measurement of the element.

18. The apparatus of claim 17, wherein said timer (106) value is one of a
15 TSF timer (106) and a part of the value of the TSF timer (106).

19. The apparatus of claim 18, wherein:
said Measurement Request Frame (300) is formatted to comprise the following
fields

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	Category	Action	Dialog Token	Measurement Start Time	Measurement Request Elements
Octets:	1	1	1	8	variable

- a Category field (301) set to the value indicating a Radio Measurement or Spectrum Management category,
- an Action field (302) set to the value indicating a Measurement Request,
- 25 • a Dialog Token field (303) set to a non-zero value chosen by the transmitter of the Measurement Request Frame in order to identify the request/report transaction,

- a Measurement Start Time field (304) set to a TSF timer value, at which the measurement specified by the first Measurement Request element is to start and the Measurement Start Time is set equal to zero, the measurement specified by the first Measurement Request element is to begin after reception of the Measurement Request Frame 300,
- a Measurement Request Elements field (305) having at least one Measurement Request Element,

and the Measurement Request Elements field is formatted to comprise the following subfields -

Element ID	Length	Measurement Token	Measurement Mode	Measurement Type	Measurement Request
1	1	1	1	1	variable

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- an Element ID subfield (401) set to a unique identifier,
- a Length subfield (402) is variable and depends on the length of the Measurement Request subfield, and the minimum value of the Length subfield is 3,
- a Measurement Token subfield (403) set to a non-zero number that is unique among the Measurement Request Elements (305) in a particular Measurement Request Frame (300).
- a Measurement Mode subfield (404) set to include a Start (407) mode subfield that specifies the interpretation of the Measurement Frame Start Time to be applied to the measured element,
- a Measurement Request subfield (406) set to at least one parameter for accomplishing the type of Measurement Type, and is formatted to comprise the following subfields -

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	Channel Number	<u>Measurement Start Time</u>	Measurement Duration
Octets:	1	8	2

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- a Channel Number subfield (431) set to the channel number to which the measurement request applies,
- a Measurement Start Time subfield (432) set to the time at which the Measurement Request is to start,
- a Measurement Duration subfield (433) set to the time over which the measurement is to be done.

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20. The apparatus of claim 19, wherein the control processor (105) is further configured to set the Start subfield (407) of the Measurement Mode subfield (404) to a value selected from the group consisting of -

The measurement is required to commence at the indicated Start Time,
The measurement is required to commence at some random interval after the indicated Start Time,
The measurement may start at any time,
The measurement is required to start immediately after receiving the request,
The actual measurement start time shall be reported back, and
The actual measurement start time may not be reported back.

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21. The apparatus of claim 20, wherein said indicator is encoded with a three bit encoding (407).

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22. The apparatus of claim 21, wherein said three bit encoding (407) is -

x00	The measurement is required to start at the indicated start time,
x01	The measurement is required to commence at some random interval after the indicated start time,
x10	The measurement may start at any time,
x11	The measurement is required to start immediately after receiving the request.
1xx	The actual measurement start time shall be reported back, and
0xx	The actual measurement start time may not be reported back.